HORTICULTURAL SUBSTATION

McDONALD'S CORNER

NEW BRUNSWICK

PROGRESS REPORT

1953 - 1957

EXPERIMENTAL FARMS SERVICE

CANADA DEPARTMENT OF AGRICULTURE

OTTAWA, ONTARIO

CONTENTS

METEOROLOGICAL RECORDS

Weather records, taken in co-operation with the Meteorological Division of the Department of Transport, have been kept on the Substation since 1949.

The average annual precipitation for the nine-year period 1949 - 1957 was 43.34 inches, fairly evenly distributed throughout the year. The average precipitation for the three summer months, for the nine-year period, was as follows: June, 3.09 inches; July, 2.94 inches, and August, 3.78 inches. The distribution of this rainfall in June and July is generally such that droughty conditions occur and supplemental water must be applied to crops. Excessive precipitation is not general but during the past nine years there have been seven months with over six inches precipitation, one month with over seven inches,and two months with over nine inches of precipitation.

Average temperatures for the three summer months have been as follows: June, 60.4°F; July, 66.4°F; and August, 64.7°F. These temperatures are somewhat low for heat-loving crops. Frequently, because of this lack of summer heat, poor crops of corn, cucumbers, and grapes are obtained at the Substation even though the frost-free period is usually ample. The average dates of last spring and first fall frosts are May 14 and October 2, respectively. This gives an average frost-free period of 139 days for the past nine-year period.

Detailed yearly records of temperatures, precipitation, and frost-free periods are given in Tables 1 to 3, inclusive.

Table 1 - Meteorological Records
Horticultural Substation, McDonald's Corner, N.B.
1949 - 1957 (9 years)

Month	Av. Temperature, F.°			Av. Precipitation, Inches		
	Highest	Lowest	Mean	Rain	Snow	Total
January	48.8	-17.6	19.1	2.10	24.25	4.53
February	46.1	-14.4	20.8	1.62	24.77	4.10
March	52.2	- 4.2	27.5	1.95	13.02	3.25
April	66.1	19.1	40.5	3.35	2.14	3.56
May	80.2	28.8	50.5	3.03	0.14	3.04
June	87.3	37.8	60.4	3.09	---	3.09
July	88.0	46.1	66.4	2.94	---	2.94
August	87.0	43.2	64.7	3.78	---	3.78
September	80.9	32.7	56.7	3.42	---	3.42
October	71.4	24.7	47.1	2.57	0.87	2.66
November	61.1	12.0	36.8	4.30	5.19	4.82
December	52.1	- 6.1	25.2	2.60	15.86	4.19
Annual				34.75	86.24	43.38

Table 2 - Annual Precipitation in Inches

Horticultural Substation, McDonald's Corner, N.B.

1949 - 1957 (9 years)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1949	3.48	2.40	4.04	2.84	3.75	2.62	1.77	0.80	9.08	2.19	6.95	3.79	43.71
1950	2.48	3.47	2.32	3.53	0.76	4.41	2.66	5.35	0.60	2.81	9.61	5.45	43.45
1951	4.16	4.98	2.51	3.36	3.72	2.19	3.60	4.22	4.25	2.83	6.14	4.93	46.89
1952	6.09	6.11	1.85	3.38	2.05	3.87	1.83	4.92	2.58	2.69	1.97	2.75	40.08
1953	5.02	4.09	4.73	3.93	2.69	2.71	6.57	3.75	5.09	3.64	2.92	4.81	49.95
1954	5.48	5.33	3.08	4.52	4.59	5.14	2.11	2.88	2.65	5.62	3.65	6.40	51.45
1955	3.77	4.93	4.14	2.97	3.20	2.18	2.11	3.35	1.82	0.91	2.19	1.68	33.25
1956	7.00	2.83	4.25	3.81	4.28	2.93	2.58	3.03	2.86	1.87	3.49	3.58	42.51
1957	3.30	2.70	2.32	3.71	2.33	1.80	3.21	5.72	1.86	1.12	6.46	4.34	38.87
9-Year Ave.	4.53	4.10	3.25	3.56	3.04	3.09	2.94	3.78	3.42	2.66	4.82	4.19	43.34

Table 3 - The Occurrence of Frost and Frost-Free Period

Horticultural Substation McDonald's Corner, N.B.

1949 - 1957 (9 years)

(Freezing Temperature 32 degrees F., or lower)

Year	Frost in Spring	Frost in Fall	No. Frost-Free Days
1949	May 21	October 2	133
1950	May 22	September 20	120
1951	May 18	October 13	147
1952	May 7	September 15	130
1953	May 3	September 24	143
1954	May 13	October 7	146
1955	May 2	October 6	156
1956	May 29	September 27	120
1957	May 17	October 21	156
Average	May 14	October 2	139

Date of latest spring frost on record	May 29
Date of earliest fall frost on record	September 15
Shortest frost-free period on record	120 days
Longest frost-free period on record	156 days

STRAWBERRIES

Cultural Studies with Strawberries

(W. B. Collins)

Introduction

This section deals with the results of four experiments designed to improve strawberry production by means of cultural practices and the use of healthy plants.

Decreased yields and a relatively high incidence of non-virus disease complexes such as root rot were the two factors that prompted these studies. The circumstances contributing to this situation lay in local practices and conditions. The tendency has been to crop certain favored fields to strawberries and potatoes continuously thus seriously depleting the soil of organic matter and nutrients and increasing the acidity. There was also the possibility of winter injury due to inadequate mulch cover.

The locations on the Substation used in these studies are typical of soils in the area and the results obtained are applicable in the district.

Strawberry Mulches

Winter mulches play an important role in strawberry production, particularly during open winters. The aim of the study on mulches was to find the best materials and rates of application to obtain maximum protection together with satisfactory yields.

Oat straw mulches provided the most efficient winter protection for strawberries. The trial showed that the amount of straw applied was more important than the time of application. Whether the mulch was applied before or after ground temperatures reached 20°F did not affect either yield or plant stand and vigor.

As a rule the yield of strawberries obtained has been inversely proportional to the amount of mulch applied. That is, the lighter yields were obtained where heavier amounts of straw were applied. The larger amounts of straw became compacted by the weight of the snow cover. This in effect created an almost air-proof barrier that contributed to smothering and subsequent plant loss prior to mulch removal in the spring. A straw mulch of from 1.5 to 3 tons per acre appears most suitable for average winter conditions.

In three years out of five, the unmulched plot ranked near the top in yield. These high yields were obtained following winters of heavy snow cover. It would appear, therefore, that snow alone makes an effective mulch. It was observed also that evergreen boughs were most efficient in years with good snow cover; during open winters, boughs did not provide adequate protection.

The use of oats seeded in the fall has not been satisfactory. The winter protection provided appeared reasonably good, but the straw choked out a number of plants in the spring and decreased yields accordingly. When the straw was burned off in the spring, yields obtained were more in keeping with yields from the better plots. To use this method to advantage the straw must be removed from the row previous to new growth in the spring.

Sawdust, shavings, and peat moss were the other materials under test. Shavings gave the best results from the standpoint of yield. These materials all provided good winter protection of plants but posed a problem of spring and summer management. Total removal of the materials in the spring is neither practical nor economical, so that they had either to be completely raked off the plants onto the space between the rows or a proportion only raked off, the plants having to push their way through the residue.

The former method resulted in large amounts of material between the rows which effectively smothered all growth underneath and served to narrow the fruiting area considerably. This loss of row width had the expected effect of reducing yields. The second method gives a smooth expanse of the mulching material over the entire area with a reduced amount covering the plants, which push their way through the mulch. This had the advantage of eliminating the weaker plants and effected a degree of plant thinning in heavy runnering varieties, such as Senator Dunlap. The yields obtained, however, were still below average; only when extra nitrogen was supplied to these mulches were comparable yields obtained. Table 4 shows average yields from three plots of each mulch over the five-year period.

Table 4 - Average yield of strawberries from 1/100 Acre Plots subjected to various mulch treatments.

Treatment	Yield in Quarts Per Plot					
	1953	1954	1955	1956	1957	Mean
Straw mulch at rate of 1.5 tons/acre.	53.67	27.29	42.94	66.57	53.60	48.81
Straw mulch at rate of 3.0 tons/acre.	54.39	26.38	37.07	60.34	55.91	46.82
Straw mulch at rate of 4.5 tons/acre.	57.06	27.97	31.70	60.05	45.37	44.43
Straw mulch (3 tons) before ground temperature reaches 20°F.	42.01	20.23	38.07	47.15	54.66	40.42
Straw mulch (3 tons) after ground temperature reaches 20°F.	51.36	27.43	30.03	60.02	50.57	43.88
Oats seeded in fall	24.47	37.94	31.56	57.58	---	37.89
Evergreen boughs	45.54	28.97	38.10	57.74	58.30	45.73
Shavings	48.48	16.95	40.95	72.42	31.70	42.10
Sawdust	22.10	17.08	16.69	60.68	44.96	32.30
No mulch	30.76	35.85	34.82	53.12	59.90	44.89
Peat moss	---	---	---	---	22.17	22.17

Heavy Organic Matter Studies with Strawberries

Seven treatments, designed to increase the organic matter content of the soil rapidly, have been utilized in this experiment. Several kinds of organic material in addition to manure were tested as the latter is generally in short supply in the area.

The treatments were chopped hay and composted hay at the rate of six tons per acre, peat moss, sawdust,each applied to a four-inch depth, manure at sixty tons per acre, a clover sod and a limed clover sod. The sod without lime may be considered as the check treatment.

The treatment applications were made in each of the first three years of a six-year rotation and were followed by a hoed crop and two years in strawberries. With the exception of the sod treatments the various amendments were plowed under in the fall and oats were grown on them throughout the three-year conditioning period. The oats served as an indicator crop and enabled adjustments to be made in the rates of supplementary nitrogen necessary with the various amendments.

In the initial stages of the experiment 14 pounds of actual nitrogen per ton of hay and composted hay applied, was employed in addition to the grain fertilizer in each of the three years; the peat moss and sawdust treatments received 21 pounds of actual nitrogen per acre for each inch of material applied. This supplementary nitrogen was necessary to provide for efficient decomposition of the amendment materials. The amounts applied for hay and composted hay proved to be adequate but oat crops following the peat moss and sawdust amendments indicated that nitrogen was in short supply. The rate of supplemental nitrogen fertilization was therefore increased on these treatments until sufficient was available for normal plant growth. Sawdust required 110 pounds per acre of nitrogen for each inch of sawdust applied. In most years, because of the excess amounts of these materials added to the soil, small amounts of supplemental nitrogen had also to be applied to hoed and strawberry crops growing on these plots.

Complete six-year cycles of each of these treatments have been concluded and a number of observations can now be made.

The performance of the indicator oat crops grown on the hay, composted hay, manure, peat moss, and sawdust amendments throughout the three-year conditioning period are of some interest and illustrate the importance of using adequate nitrogen supplements with materials such as sawdust and peat moss.

Over the whole period yields of oats on plots treated with peat moss and manure were significantly higher than yields from all other plots. Yields from sawdust-treated plots were significantly lower than those from any other of the five treatments being compared.

A different picture is obtained, however, when the yields are compared following one, two, and three years of treatment. One year of treatment re-

sulted in top yields from manure-treated plots with all other treatments being superior to peat moss and sawdust. After two years of treatment the situation changed and yields from peat-moss treatments were high with all other treatments still being superior to sawdust. Following three years of treatment, however, yields from both peat moss and sawdust were superior to those from all other treatments. This is explained in part by the fact that during the last two years of treatment, extra nitrogen, over and above the original allotment, was supplied.

The manure treatment was the only one of the seven that had any significant effect upon hoed crop yields. Yields of marketable potatoes from manure plots were significantly higher than those from any other treatment. The starch or dry-matter content was highest in potatoes grown on composted hay and lowest on those plots receiving manure.

The ultimate value of these organic treatments is their effect on the strawberry crop. This can best be illustrated by Table 5, bearing in mind that the average yield on adjacent untreated plots during 1951 and 1952, two years prior to treatment, was found to be only 3959 quarts of strawberries per acre.

Table 5 - The Effect of Organic Treatments on Strawberry Yields - Quarts Per Acre, 1953 - 1957.

Year	Chopped Hay	Com. Hay	Peat Moss	Sawdust	Manure	Sodlimed	Sod
1953	7222	7429	7942	8699	10752	8474	6778
1954	6731	6603	5138	4719	7561	6609	4984
1955	7088	8099	7883	7000	6208	6862	6230
1956	8777	9868	9389	8271	7241	7021	7068
1957	7221	8180	5757	5631	6845	7688	6222
Mean	7408	8036	7222	6864	7721	7333	6256

Average yields for the five year period of treatment indicate that the greatest yield increases were from plots treated with composted hay, followed in order by manure, chopped hay, sod limed, peat moss, sawdust and sod. The manure treatments gave the greatest initial yield increases in 1953 and 1954, suggesting the immediate influence of manure following one and two years of treatment previous to the strawberry crop. Composted hay replaced manure after the full three years of treatment had been applied. This supports the conclusion that a period of time must elapse before this material becomes effective and that at least 18 to 20 tons per acre of this amendment is needed to give maximum results.

A statistical analysis of the above data indicates that strawberry yields from plots treated with composted hay were significantly higher than from all other treatments with the exception of manure and chopped hay. In other words, treatments of greatest benefit to strawberry production were composted hay, manure and chopped hay.

Bouyoucos moisture blocks have been placed at root depth in the fruiting strawberry plots since 1954. Readings taken from these blocks show moisture available to the plants over the production period June 1 to July 20. Figure 1 shows soil moisture curves for the various treatments obtained from these data. These curves represent the natural moisture supply in per cent with no supplementary irrigation.

Compared with the other treatments, peat moss applications not only held more moisture available to the plant, but reduced moisture losses during droughty periods. Moisture losses under sawdust were also not so extreme as for the remaining treatments. However, when the sawdust plots did become dried out during a droughty period, excess amounts of water were required to restore a moisture balance comparable with the other treatments. The remaining amendments showed some slight variation in their influence on moisture holding capacity, but were nearly equal to one another except for manure which held little available moisture and permitted extreme variations.

Through the co-operation of the Regional Laboratory, Chemistry Unit, Science Service, Kentville, N.S., annual analyses have been made of soil samples from each group of plots immediately following a conditioning period. These results are given in Table 6 together with analyses of samples taken on the same plots previous to treatment. A study of the figures indicates that a number of changes due to treatment have occurred.

The comparison shows that there has been a decrease in soil acidity for all treatments with the exception of peat moss, sawdust, and sod which had a significant increase in acidity. Total nitrogen was increased by all treatments with the greatest increases occurring where manure, peat moss, and sawdust were applied. As would be expected, the organic-matter content was increased by all treatments with highly significant increases resulting from peat moss, sawdust, and manure treatments. The organic matter — nitrogen ratios associated with peat moss and sawdust are much too high indicating that nitrogen was in excess in these plots.

The base exchange capacity of the treated soils was raised significantly by peat moss, sawdust, and manure and to a lesser extent by the sod and hay treatments. The percentage base saturation, however, has risen markedly for all treatments with the exception of sod in which the increase was slight. Corresponding increases in exchangeable bases occurred and are shown in the table. The manure treatment has created the most favorable situation. The readily acid soluble and absorbed phosphorus increased substantially under all treatments except peat moss and sawdust. Sawdust actually showed a decrease in this characteristic and manure gave the greatest increase.

Examination of the soils at the time of writing showed that a proportion of the peat moss and sawdust had not composed and hence more time will be required for these treatments to reach an equilibrium.

It is apparant to date that three treatments, peat, moss, sawdust, and manure have had the greatest effects on the physical properties of the soil. An overall as-

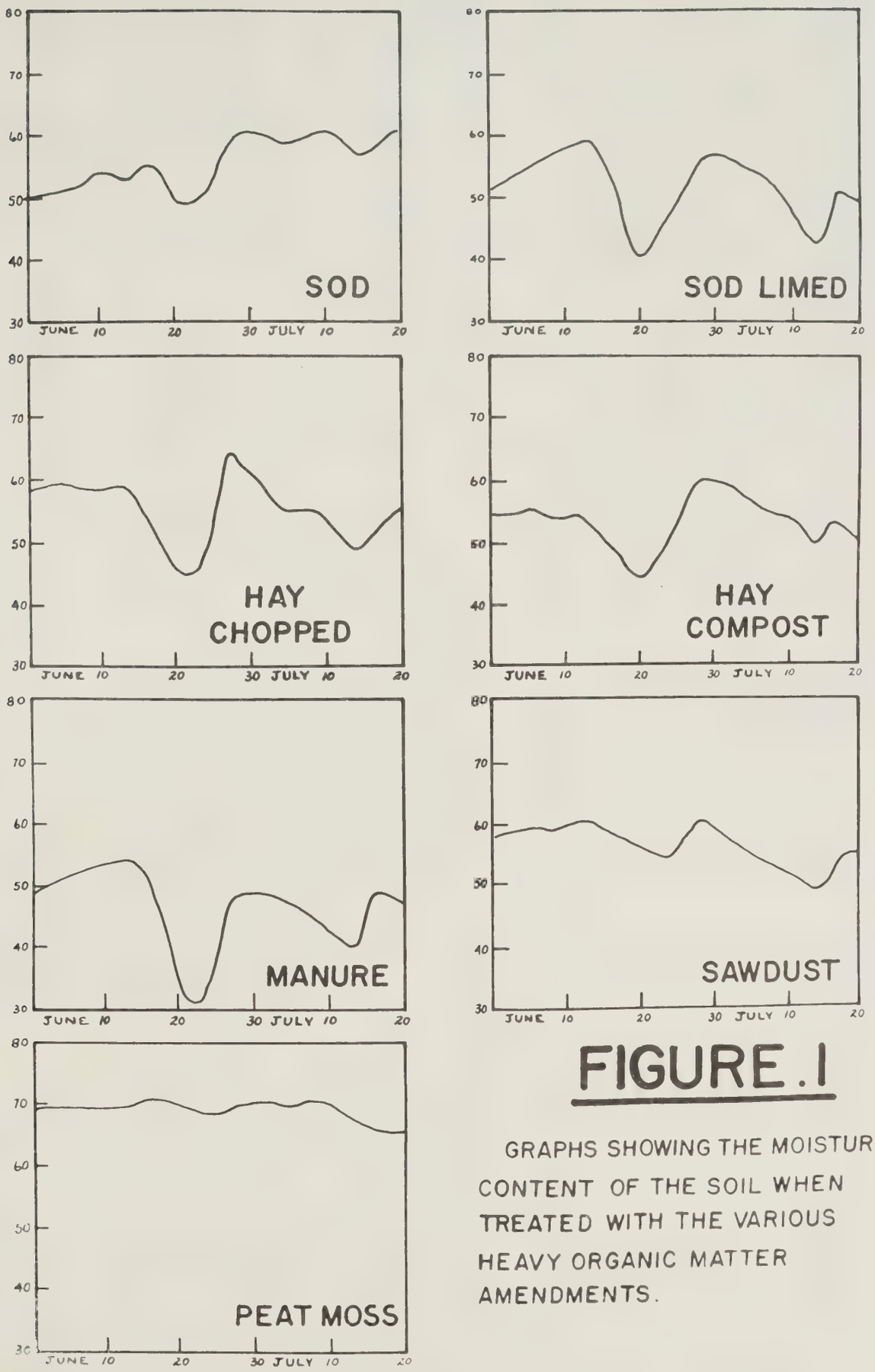

FIGURE. I

GRAPHS SHOWING THE MOISTURE CONTENT OF THE SOIL WHEN TREATED WITH THE VARIOUS HEAVY ORGANIC MATTER AMENDMENTS.

Table 6 - Analysis of Soil Samples from Plots Heavily Treated with Organic Matter
*(Results Expressed on an Air Dry Basis)

Treatment	pH		Nitrogen (N) %		Organic Matter %		Ratio O.M:N.		Readily Acid Soluble & Absorbed P - p.p.m.	
	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment
Chopped Hay	5.05	5.27	0.17	0.22	4.06	5.56	24:1	26:1	140	164
Composted Hay	5.14	5.20	0.18	0.22	4.13	5.05	23:1	23:1	137	172
Peat Moss	5.15	4.48	0.18	0.28	3.93	15.12	22:1	53:1	139	150
Sawdust	5.08	4.84	0.18	0.26	4.10	20.78	23:1	76:1	140	136
Manure	5.01	5.48	0.18	0.31	4.13	7.69	23:1	25:1	136	386
Sod Limed	5.08	5.18	0.18	0.22	4.18	5.38	23:1	24:1	165	191
Sod	5.18	4.93	0.18	0.20	4.11	5.10	24:1	25:1	134	172

Treatment	Base Exchange Cap. m.e./100 gm.		Base Saturate. %		Calcium (Ca) m.e./100 gm.		Magnesium (Mg) m.e./100 gm.		Potassium (K) m.e./100 gm.	
	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment	Previous to Treatment	Following Treatment
Chopped Hay	12.6	14.7	32.0	48.9	2.64	5.10	0.71	0.88	0.33	0.99
Composted Hay	13.8	14.0	34.1	50.2	3.21	5.20	0.89	0.91	0.34	0.79
Peat Moss	12.7	29.6	32.8	40.2	2.90	7.32	0.81	2.75	0.36	0.97
Sawdust	12.7	23.8	29.1	38.1	2.61	6.80	0.68	1.80	0.31	1.01
Manure	13.7	18.2	31.4	65.3	2.98	8.08	0.77	2.30	0.33	1.41
Sod Limed	13.0	14.4	33.7	45.2	3.03	4.37	0.82	1.11	0.33	0.88
Sod	13.8	14.4	33.2	34.8	3.07	3.40	0.84	0.63	0.32	0.77

* Analyses courtesy of Chemistry Unit, Science Service, Kentville, N.S.

sessment of the treatments at this time is favorable to one of the hay treatments, particularly composted hay. Peat moss is also a possibility. This assessment is based on the assumption that manure is not available or is in short supply. It would seem desirable to use peat moss at a lower rate than was utilized in this experiment.

Rotation Studies with Strawberries

In a series of tests to improve strawberry production, rotations included crops that would tend to build up the organic-matter content of the soil. These were:

(1) Three-year rotation -- soybeans, and two years in strawberries,

(2) Three-year rotation -- millet and two years in strawberries,

(3) Four-year rotation -- oats, clover and two years in strawberries,

(4) Five-year rotation -- three successive years of soybeans and two years in strawberries,

(5) Six-year rotation -- oats, clover, timothy, potatoes, and two years in strawberries.

The soybean and millet crops, where they occur in these rotations, were plowed under before maturity as green manure crops. Additional organic matter was provided in the last year of each rotation when the strawberries were plowed under immediately after harvest and followed by crops of buckwheat and fall rye, each of which was plowed under for green manure purposes.

At the time of writing, the three-year rotations have each completed two cycles, while the others have completed one.

Table 7 - Yields and Yield Increases of Strawberries in quarts per acre from the Various Rotations.

	3-yr. (Soybean)	3-yr. (Millet)	4-yr. (Oats, Clover)	5-yr. (3-yr. in soybean)	6-yr. (Oats, Clover, Timothy, Potatoes)
Yield Previous to start of Rotation	3,568	2,972	3,504	3,630	2,432
Yield following 1 complete cycle	5,906	7,052	4,622	5,834	6,332
Yield following 2 complete cycles	7,408	7,756	-----	-----	-----
Increase in Yield After 1 cycle	2,338	4,080	1,118	2,204	3,900
Increase in Yield After 2 cycles	3,840	4,784	-----	-----	-----

L.S.D. P.01 = 2630; P.05 = 1998

Table 7 shows average yields for the various rotations previous to and following the implementation and completion of the rotation cycles. Also shown are the increases in yield that have been effected by these rotations.

The three rotations returning green manure crops to the soil have had the greatest effect in increasing yields. The increase in yield following one cycle of the four-year rotation did not prove to be significant and that of the six-year rotation was just barely so. The greatest increases occurred following the three-year millet rotation followed in turn by the five-year and three-year soybean rotations. The tilth and texture of the soil have been noticeably improved by these three rotations and this is particularly true of rotation 2.

The above results add support to those obtained in the heavy treatment series, namely, by increasing the organic-matter content of these soils quite radical improvements in yield can be obtained.

Limestone Studies on Strawberries

Applications of ground limestone at rates of 500, 1000, 1500 and 2000 pounds per acre have been applied previous to the grain crop in a four-year rotation of grain, clover, strawberries, and strawberries. Unlimed plots have served as checks. One complete cycle of the rotation has been concluded and a second one will be concluded in 1958.

At the conclusion of one cycle little concrete evidence of the effect of liming on strawberry production is available. In general, the trend in yield appears to be upward as the rate of liming increases, but the results are not conclusive or consistent. The same comments can be made of the oat yields in the rotation. Hay yields, however, have increased as the rate of lime has been increased.

Soil pH responses from these lime applications have been disappointingly low and inconsistent which probably accounts for the correspondingly variable results in crop yields. Until definite responses are obtained further applications of lime will be made in this series.

Management Studies with Strawberries

In the Substation area strawberries are commonly grown in matted rows. It has often been felt that this method of growing prolific runner producing varieties, such as Senator Dunlap, results in many small plants competing for moisture and nutrients and consequently a reduction in yield. To test this hypothesis plots were laid out in which rows pruned by chemicals and by hand were compared with an untreated matted row. The chemical pruning agent used was maleic hydrazide and the hand-pruned plots consisted of a modified hedge-row system composed of two rows spaced 2.5 feet apart with the production of each of the original plants limited to eight daughter plants.

The various treatments used and the average yields obtained from each are presented in Table 8.

Table 8

Treatments and Yield of Strawberry Management Trial

Treatment	Two-Year Av. Yield (quarts per acre)
1. Matted row - check.	7332
2. Modified hedge row.	9162
3. Matted row - sprayed 1,000 p.p.m. maleic hydrazide as runners begin to set.	6018
4. Matted row - sprayed 2,000 p.p.m. maleic hydrazide as runners begin to set.	5467
5. Matted row - sprayed 1,000 p.p.m. maleic hydrazide after 50% runners set.	7935
6. Matted row - sprayed 2,000 p.p.m. maleic hydrazide after 50% runners set.	4980
7. Matted row - sprayed 1,000 p.p.m. maleic hydrazide monthly from time runners begin to set.	5743
8. Matted row - sprayed 1,000 p.p.m. maleic hydrazide monthly after 50% runners set.	7550

The above figures indicate that the modified hedge row system produced yields that were significantly higher than those from all treatments but numbers 5 and 8. With the exception of these two treatments, maleic hydrazide depressed yields. The 2,000 p.p.m. rate decreased yields regardless of time of application. The 1,000 p.p.m. rates applied at time of first runner formation and at monthly intervals thereafter also depressed yields.

The results indicate that yields from the heavy-plant-setting variety Senator Dunlap can be increased by a system of mechanical or hand pruning. In attempting to achieve the same result by chemical means, maleic hydrazide is still an uncertain material as the time and rate of application are very critical factors.

Strawberry Variety Trials

(W.B. Collins)

Thirty strawberry varieties have been grown and evaluated for varying lengths of time in the variety trial during the past five-year period. Of this number

only Senator Dunlap and Sparkle have been included in each of the five years and are used as standards against which the newer sorts are compared. Senator Dunlap is still the most widely grown variety in the area, but on the basis of varietal trial results, should now be replaced by newer, more vigorous types.

Sparkle has proved to be a profitable variety for main crop plantings with an average yield over the five-year period of 8,300 quarts per acre. Good quality, appearance, and firmness are combined with yield and it makes and excellent shipper. Sparkle is a midseason variety and both an early and a late variety is needed to extend the harvest season.

The best early variety grown in the trial until recent years has been Valentine. This variety, however, is lacking in quality, and both size and yields drop off markedly as the season progresses. In 1955 and 1957 the Ottawa-developed variety, Cavalier, was tested and averaged better than 9,000 quarts per acre for the two-year period. The fruit is very attractive, well sized and ships well. The variety is promising as an early or possibly even a main-crop type for New Brunswick.

No really good late variety has yet proved itself in the variety trial. The standard late varieties, Louise and Elgin, have not proved adaptable to the substation area. Two new varieties of some promise have been Stafford (University of New Hamsphire) and Guardsman (Ottawa). Both have disadvantages. The former is not a prolific plant maker and the latter has a tendency towards winter injury. Yields of both varieties are moderate and both are recommended for trial on a small scale where a late variety is desired.

Varieties that have shown promise in the trial as compared with Senator Dunlap and Sparkle are as follows:

Grenadier (11,800 quarts), Redcoat (9,900 quarts), Main 55 (9,500 quarts), Fairland (9,300 quarts), and Redcrop (8,700 quarts). Generally speaking, all are midseason types with good fruit characteristics. It should be borne in mind that these varieties have been grown for a relatively short time and a full assessment of their potential has not been possible. They appear, however, to be worthy of more extended planting on a trial basis.

Virus-free and Common Stock Strawberry Plants

In 1953, virus-free strawberry plants were introduced by the United States Department of Agriculture, and since that time, considerable quantities of such stock have been imported and grown in commercial areas of the province. To test the effectiveness of virus-free stock in increasing yields, a comparison was made in 1956 and 1957 of common-stock and virus-free stock of six varieties of strawberries. The common stock was composed of material that had been propagated at the Substation for a number of years; the virus-free stock was imported from an American nursery. The varieties included in the trial were; Catskill, Fairfax, Premier, Robinson, Senator Dunlap, and Sparkle.

Yield results indicated that increases of 50 per cent or more were obtained by the use of virus-free plants of Premier and Sparkle. Increases in yield over common-stock plants were also obtained with virus-free Catskill and Senator Dunlap but the differences were not large. Common-stock plants of Fairfax and Robison, on the other hand, were equal to or superior to virus-free plants.

On the whole, the trial points up the fact that superior yields of some of our commercial varieties can be obtained by the use of virus-free stock. This trial will be continued using plants from the same stocks in order to determine the length of time virus-free plants can maintain their yield superiority. In both cases, the plants will be propagated in the program outlined under the strawberry propagation section.

Strawberry Propagation

(W.B. Collins)

The health and vigor of common and virus-free stocks of the various strawberry varieties at the substation has been maintained very well over the years by means of a clonal planting system in the propagation areas, supplemented with a spray program for insect control.

In this system, plants are set five feet by five feet on the square and are rogued at frequent intervals. This means that the plants are separated so that any infected or suspicious plant may be removed and destroyed, together with all runner plants that have developed from it. Insect control is obtained as thoroughly as possible by means of malathion sprays at intervals of approximately seven to ten days from planting to dormancy.

Entomological Investigations

(G.T. Morgan)

Entomological work at the research station was started in 1949 as a result of the work of C.W. Maxwell of the Entomological Laboratory at Fredericton on the biology and control of the strawberry weevil. When the station was set up, the Experimental Farms Service provided land, equipment, and labor facilities to the Fruit Insect Unit of the Entomology Division, Science Service, to conduct insect investigations. Most of the research work is carried out at the station or in suitable commercial strawberry plantations in central New Brunswick.

The initial phase of the work was a survey to assess the entomological problems of the industry and their relative economic urgency. Most strawberry pests were collected in the area and the following were found in sufficient numbers to warrant concern:

Common Name	Scientific Name
Strawberry weevil	Anthonomus signatus Say
Strawberry leaf roller	Ancylis comptana fragariae (W. & R.)
Strawberry root weevil	Brachyrhinus ovatus (L.)
Black vine weevil	Brachyrhinus sulcatus (Fab.)
Cutworms	Euxoa messoria (Harr.)
Cutworms	Euxoa declarata (Wlk.)
Strawberry leaf bettle	Paria fragariae Wilcox
Spittle bug	Philaenus sp.
White grub	Phyllophaga sp.
Flea beetle	Psylliodes punctulata Melsh
Red-headed flea beetle	Systena frontalis (F.)

The strawberry fruit bug, Calcoris norvegicus (Gmel.), was not collected nor was damage by it observed. The survey showed seven species of aphid on strawberry, the following three being considered the most important vectors of strawberry viruses in Europe and America: Pentatrichopus fragaefolii (Ckll.), P. minor (Forbes), and P. thomasi Hrl. An economic pest of strawberry, Chlamisus fragariae Brown, discovered in 1949, did considerable damage to some plantations in 1952 and 1953.

Also, examinations of strawberry plantations showed that fungus and virus diseases were widespread and that a condition known as strawberry root rot reduced yields seriously.

Work was immediately begun on the most pressing problems: (1) life history, behavior, and control of virus-carrying aphids; (2) root rot control; (3) an adequate insect and disease protection program.

The life histories and habits of the three main virus-transmitting aphids were found to be similar. Over-wintered eggs hatch in May and several wingless parthenogenic generations are produced. These disperse to the plantings and produce new colonies. From late September to freeze-up, sexual forms are produced and eggs are laid on the undersides of the leaves and on the stems.

In 1953, a series of experiments was begun to test soil fumigants in controlling strawberry root rot. Results so far indicate some value in fumigation although a number of problems have to be solved before general use of fumigants can be recommended with confidence. The main difficulties encountered so far have been phytotoxicity in some soil types, different responses of native and virus-free plants to some fumigants, and the fact that suitable soil temperatures have occurred too late in the spring for applying fumigant.

An experiment is now under way to compare the value of four fumigants in spring, midsummer, and fall applications in alleviating root rot and increasing yields. One test of spring fumigation showed that dichloropropane-dichloropropene mixture significantly increased strawberry yields. Complete results will be available in 1959.

An important project recently arising out of the problem of root rot control is the study of plant-parasitic nematodes as possible associates of root rot. This work is under the direction of Dr. A. D. Baker, in charge of nematode investigations, Entomology Division, Ottawa. The project formally got under way in 1957.

An insect and disease protection guide for strawberries has been set up and developed in co-operation with the Botany and Plant Pathology Division, Canada Department of Agriculture, and the Division of Plant Protection, New Brunswick Department of Agriculture. Our role has been to experiment with materials and recommendations found satisfactory in other areas, to assess these recommendations in the light of local conditions and cultural practices, and to recommend changes in the "Protection Guide" as research progresses. The present protection program is based on results obtained at the research station where worthwhile increases in yields have been obtained from the proper applications of fungicides and insecticides, including fumigants.

In general, wherever possible the entomological research is complementary to the horticultural research program at the station but the two are not formally integrated. The objective is to advance the strawberry industry in the Maritime Provinces.

BUSH FRUITS

(W. B. Collins)

Experimental work with these crops has been limited in the main to varietal work and includes the following fruits: raspberries, currants, gooseberries, and grapes.

The rasberry plantation has been fruiting commercially for the past four years and includes the varieties Gatineau, Madawaska, Muskoka, Ottawa, Rideau, Trent, Tweed, and Viking.

The top varieties in the trial have been Trent, Muskoka, Madawaska, and Tweed in the order named. Trent has been a particularly good early type and is becoming widely distributed in the province. Muskoka can also be recommended highly.

The color of Madawaska and Tweed is considered to be too dark for the fresh fruit market. The chief value of these varieties seems to be for the home garden where the fruit can be harvested daily. Madawaska, in particular, is a fine canning berry.

All varieties have shown some degrees of winter injury in some years, but generally speaking, such injury in the top four varieties has been very slight. Of the remaining varieties, Viking and Rideau have been particularly susceptible to winter injury; Gatineau and Ottawa moderately so. Yields of the latter four varieties have been unprofitably low.

Currants

The three rust-resistant varieties, Crusader, Coronet, and Consort have been compared with such standard varieties as Magnus, Climax, and Saunders.

The varieties have yielded in the order named, and on the average, have produced three to four times more fruit than the standard sorts during the three-year period they have been fruiting.

Gooseberries

The Ottawa thornless originations Captivator, 0-271, 0-273, 0-274, and 0-275 have been compared in this trial with Clark, Poorman, Sylvia, and Ross.

Good commercial yields of fruit have been obtained from Poorman, 0-271, Captivator, and Sylvia in the order named. Yields from the remaining varieties and seedlings have not been outstanding.

Grapes

Grapes have yielded well at the Substation only two years out of the past five. Yields were curtailed in 1955 and 1956 by short, cool growing seasons, and bud injury suffered during the winter of 1956-57 limited the 1957 crop.

The hardiest and most productive varieties have been Fredonia, Portland, and Van Buren. The average yield for these three varieties over the five-year period has been slightly over two tons per acre, although yields in excess of five tons have been obtained. Other varieties in the trial include Kendaia, Eden, and Seneca.

TREE FRUITS

(R.G. White and W.B. Collins)

Tree fruit plantings at the Substation include apples, pears, and plums. These plantings were made to investigate the possibility of profitable fruit growing in this area. Little information is available yet as the trees are just beginning to come into bearing. In many cases, bearing has been abnormally delayed because of damage caused by browsing deer. These animals are particularly harmful to the smaller trees.

The main apple planting comprises 134 trees made up of 7 named and 33 seedling varieties. Aside from varying amounts of bud injury on some varieties all appear to be doing well. As the trees come into full bearing, a further assessment of their potential will be possible.

A second apple planting made up of several common varieties on East Malling 1X dwarf rootstocks compared with the same varieties on standard roots

has been disappointing, as many of the dwarf trees have proved to be untrue to variety. The dwarf trees, however, have been in production for about three years whereas the trees on standard rootstocks are only now beginning to bear a small quantity of fruit. Wind breakage can be a serious danger with dwarf trees unless staking is practiced.

The pear planting consists of 14 varieties with four trees of each variety. Several losses due to winter injury have been experienced, particularly with the varieties Cayuga, Gorham, and Beurre Gifford. Other varieties in the trial have been hardy to date. The most productive sorts have been Covert, Bartlett, Mendel, and Phileson. Little to no fruit has been obtained yet from the remaining varieties.

Four trees each of 42 varieties of plums have been set out and the orchard has grown well. Both European and Hybrid plums are included in the trial. To date only the European types have borne any fruit, chief among these have been Bonne Ste. Anne, Latchford, English Shropshire Damson, Yellow Egg, Lombard, Prescott, and Raynes. Pollination difficulties experienced with the hybrid sorts make them a doubtful proposition.

VEGETABLES

Variety Trials

(R.G. White and W.B. Collins)

Variety trials have been chiefly with vegetables grown commercially in the district. In the period covered by this report, some 32 varieties of bush beans, 40 of cucumbers, 5 of muskmelons, 45 of garden peas, 74 of sweet corn, and 54 of tomatoes, have been under observation. A number are recommended:

Bush Beans:-	Early-- (wax) Cherokee, (Green) Contender Main Crop -- (wax) Cherokee, (Green) Contender, Supergreen
Cucumbers:-	Slicing -- Burpee's Hybrid, Sensation Hybrid, Highmoor (scab resistant) Picklers -- Wisconsin S.M.R. #12, (scab resistant) National.
Muskmelons:-	Farnorth, Pennsweet.
Garden Peas:-	Early -- Little Marvel, Topper Midseason -- Director, Ottawa PE-11, Victory Freezer, Wando -- Mid-freezer. (for trial)
Sweet Corn:-	Early -- North Star. Mid-season -- Seneca Arrow.
Tomatoes:-	Quebec #5, Burpeanna Early Hybrid, Scotia (new), Harrow.

Fertility Experiments With Vegetables

(W. B. Collins)

Soil fertility experiments with snap beans and sweet corn have been conducted at the Substation during the past two seasons. A factorial plot design was employed and the results were as follows:

The main factor responsible for increasing bean yields is phosphorus. Yields increased steadily with applications of phosphorus up to 200 pounds per acre, except where nitrogen and potassium were also high in which case yields were decreased. The optimum level for nitrogen lay between 50 to 100 pounds per acre and that for potassium at 100 pounds per acre. Increments of potassium beyond this level resulted in decreased yields unless nitrogen was at the lowest level. These levels would indicate the use of a fertilizer formula with a 1-2-1 ratio on these soils. Of the formulae presently in use in New Brunswick a 6-12-8 formula most closely approximates the above ratio.

Results similar to the above were obtained with sweet corn with optimum yields occurring when nitrogen, phosphorus, and potassium (6-12-8) were applied at 100, 150, and 100 pounds per acre, respectively. One hundred and fifty pounds per acre was the highest rate used for phosphorus and it is possible that a higher rate will make even further response. If such proves to be the case, it appears that a 1-2-1 ratio would also be applicable for use with sweet corn.

Irrigation for Early Potatoes

(H. T. Davies and W. B. Collins)

Since 1953, irrigation has been practiced on the early potato seedling yield trial in order to assess its effectiveness in increasing yield of marketable tubers.

The yields obtained from these trials and from early plantings in this district are subject to wide fluctuations from year to year due to variations in rainfall in early summer coupled with the shallow stony nature of the soil. In a dry season very few tubers of marketable size may be available by the end of July when harvesting normally takes place in order to take advantage of the high price level. This has varied from $2 up to as high as $7 for a 75-pound bag. When yields are reduced by drought, prices are usually high.

In the spring of 1953, a portable sprinkler irrigation system was installed and water was applied when needed to the point where 85 to 90 percent moisture was available to the plant as indicated by "Bouyoucos Blocks". Planting is carried out as early in April as possible, usually between the 20th and 30th of the month. Four replications of the trial were grown in 1953. Sets were spaced 10 inches apart in the rows, 25 sets per row. The rows were 3 feet apart. Two replications were irrigated. In 1953, only one irrigation was needed, as rainfall was adequate for the remainder of the growing season.

All yields were graded, weighed and calculated on a bushels-per-acre basis. The average for the two irrigated plots was 198.0 bushels per acre of marketable tubers and for the check replications 141.5 bushels per acre.

In 1954, and subsequent years, the number of replications was increased to eight, of which four were irrigated. Rainfall was adequate for this season and no significant results were obtained.

In 1955, the season was characterized by a prolonged dry spell in June and July. Water was applied during this period. Yields from the irrigated replications were 193.0 bushels per acre of marketable tubers as compared with 110.8 bushels per acre for the checks.

In 1956, the results were 183.6 bushels per acre irrigated, and 106 bushels per acre on the checks. Rainfall was adequate in 1957 and irrigation had no appreciable effect on yield.

The average increase for the three years when irrigation was effective, amounted to 72 bushels per acre or the equivalent of fifty-seven 75-pound bags.

The type of irrigation equipment used cost $2200. It has been estimated that the cost of such equipment works out to approximately $21 per acre per year.

Mixed farming is the practice in this region with particular emphasis on the strawberry crop. This crop also responds to a high degree to irrigation during dry periods in early summer, consequently the equipment used for the early potatoes can be put to good use for the strawberry crop as well. Results obtained over a five-year period suggest that the use of irrigation is economical for this district.

POTATO BREEDING

Yield Trials

(H.T. Davies and W.B. Collins)

Potato yield trials have been conducted at the Substation since its inception in order to assist in evaluating seedlings raised as part of the National Potato Breeding Project. These were made up of the following: (1) An early yield trial, comprising seedlings selected for their earliness on the basis of yield and maturity at the Alma Potato Substation. (2) A trial of promising seedlings bred for resistance to late blight. (3) A trial of promising seedlings bred for resistance to common scab. (4) A trial of standard varieties and new varieties introduced from the United States.

Early Seedlings

The McDonald's Corner Substation is situated in the early potato growing area of the province. Advantage is taken of this to test out seedlings of promise in comparison with the standard early varieties of the district.

Warba, the standard early variety for this district was used as the check. It is an excellent yielder but the tubers are extremely deep-eyed. Because of this fault, it was decided to try and find a seedling with equal yielding ability possessing a smoother tuber.

The trial consisted of four replications in 1953 and eight replications in subsequent years. Sets were spaced 10 inches apart in the rows, 25 sets per row. The rows were 3 feet apart. Fertilizer was applied at the rate of 1,500 pounds per acre. A 5-10-10 analysis was used in 1953 and 1954, 6-12-12 in 1954 and 1955, and 6-12-8 in 1957. Planting was carried out as early as possible, usually between April 20 and 30.

For a five-year period the average yield for Warba was 202.8 bushels per acre marketable tubers testing 17.4 per cent dry matter. The only other variety or seedling in the trial for the full five-year period was Keswick, which gave an average yield of 190.0 bushels per acre testing 18.0 per cent dry matter. Other seedlings were gradually dropped from the trials when they failed to maintain a yield as significantly high as Warba, and others took their places.

One seedling that has been outstanding for yield over a four-year period is F5113 with an average of 241.0 bushels per acre testing 17.7 per cent dry matter, compared with 213.3 bushels per acre testing 17.6 per cent dry matter for Warba, and 191.3 bushels per acre testing 18.3 per cent dry matter for Keswick for the same period. This seedling has superior tuber characteristics to Warba and it is planned to test it on a commercial basis in 1958.

The only other seedling of note that has emerged from the trials is F5284, which has been under test for 3 years. It has yielded at the rate of 236.8 bushels per acre testing 17.0 per cent dry matter, compared with 227.3 bushels per acre testing 17.9 per cent dry matter for Warba for the same period.

Common Scab-resistant Seedlings

Seedlings were selected for this trial on the basis of their yield, dry-matter content, scab resistance, maturity, and general tuber characteristics.

The trials were made up of six replications. Sets were spaced 10 inches apart in the rows, 30 sets per row, 3 feet between rows. Fertilizer rates and analysis were the same as the early yield trial.

Planting was carried out usually between May 25 and 30 each year. The variety Green Mountain was included in the test as a check for five years, and Katahdin for four years.

Compared with Katahdin over a four-year period, Green Mountain averaged 422.0 bushels per acre marketable tubers testing 20.7 per cent dry matter and stood first for yield of marketable tubers for the first two years of the trial and second for the other two years. Katahdin gave an average yield of 344.5 bushels per acre, testing 18.2 per cent dry matter for the same period and was in 6th, 10th, 7th, and 5th place, respectively, for yield of marketable tubers.

Only one seedling, F4768, was in the test for the full five-year period. It has also been in the Advanced National Trials for the last three years. It is low in yield, averaging 297.7 bushels per acre of marketable tubers testing 18.6 per cent dry matter. Tuber size suggests that it might respond to a wider spacing than 10 inches between sets.

F5080, another seedling that has been in the Advanced National Trials, and for four years in the scab seedling yield trial gave a four-year average yield of 290 bushels per acre testing 19.0 per cent dry matter. This seedling is outstanding for cooking quality and tuber appearance, but lacks yield in the Maritimes.

F4713 was included in the trial for three years. It averaged 397.0 bushels per acre marketable tubers testing 17.8 per cent dry matter compared with 442.3 bushels per acre testing 19.4 per cent dry matter for Green Mountains for the same period. This is a very promising seedling, having excellent cooking, chipping, and yielding ability. It can be faulted in that the eyes are rather deep. As a result of its performance in Nova Scotia, it is to be introduced in 1958 as a fall chipping variety for that province.

One other seedling has performed well for a three-year period, F5096 yield at the rate of 312.6 bushels per acre testing 21.8 per cent dry matter.

Late Blight-resistant Seedlings

Seedlings were selected for this trial on the basis of their performance at Alma. Replications, spacing, fertilizer treatments, and planting times were the same as for other trials at the Substation. Green Mountain was included as a check variety for five years and Katahdin for four. Green Mountain averaged 433 bushels per acre and 439.2 bushels per acre testing 20.9 per cent dry matter for the four-year period. Katahdin gave an average yield of 339.4 bushels per acre testing 18.3 per cent dry matter.

Only one seedling, F5025, was in the trial for five years. It has also been included in the Advanced National Trials for two years. It gave an average yield of 346.3 bushels per acre marketable tubers testing 18.7 per cent dry matter. It has not given a particularly good performance in the National Trials in the Maritimes. Of the seedlings that were in the trials for four years, F4631 yielded at the rate of 393.5 bushels per acre testing 17.5 per cent dry matter. This seedling has shown fairly wide adaptability in Advanced National Trials. Although rather low in dry matter, it has shown good cooking quality. F4932 averaged 360.9 bushels per acre testing 18.8 per cent dry matter. This seedling has shown considerable promise, and was recommended to be included in the Advanced National Trials in 1958, F503 and F4713 performed well over a three-year period in this trial and are reported separately as both are to be named. Two other seedlings in the trial have attracted some attention. F4724 gave an average yield for a two-year period of 369.6 bushels per acre testing 20.2 per cent dry matter. This seedling, bred for blight resistance, has shown considerable resistance to common scab and is considered a valuable source of resistance to this disease, as it does not have the drawback common to other German scab-resistant varieties of passing

on to its progeny a tendency to internal necrosis. F5284 averaged 552.9 bushels per acre testing 16.4 per cent dry matter. This seedling is quite a promising early, having also performed well in the early yield trials at the McDonald's Corner Substation for two years.